Weekly Report POS 508 (22.01-30.01.2017)

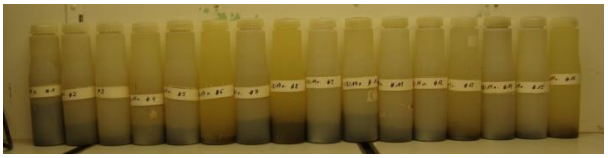
The research cruise POS508 is a collaboration between the Marum Excellence Cluster 'The Ocean in the Earth System' in the Research Area 'Geosphere Biosphere Interactions' and the Helmholtz Young Investigator Group Project 'SeaPump'. We will service our long-term moorings for export fluxes and study particle dynamics in our study region off Cape Blanc, Mauritania. The aim of our work is to study the role of sinking particles for vertical flux of organic matter. Sinking particles control carbon dioxide removal from the atmosphere and its movement to the deep ocean. They feed life below the ocean's surface sustaining the biomass of deep sea fish and other organisms and determine sediment formation on the seafloor. However, most of the organic matter produced by photosynthetic plants in the surface ocean is eaten by small animals or degraded by bacteria before it sinks deeper than 100 meters. This means that the carbon dioxide is only removed from the atmosphere for a few weeks before it is outgassed from the ocean again. The particles need to sink below 1000 meter depth to be removed from the atmosphere for more than 1000 years and only those particles reaching the seafloor will have their organic matter stored for millennia. Unfortunately we know very little about processes that remove and transform the particles as they sink through the water column and, hence, the sequestration of atmospheric carbon dioxide in the world's oceans is only poorly understood. Only by understanding those processes can we make any hopes of bringing the carbon that we have released via fossil fuel burning back into the ocean-floor. Since the end of the 19th century we humans have added more carbon dioxide to the atmosphere than accumulated there in a 5,000-year period when the last Ice Age came to an end. Back then, the ice shields covering North America and parts of Eurasia melted and caused a 130 meter sea level rise.

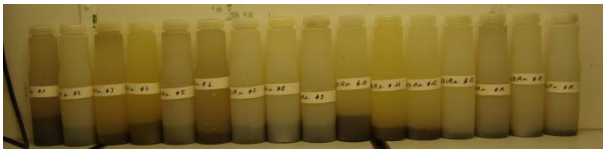
RV Poseidon left the port of Las Palmas, Gran Canaria, Spain, on 22nd January 2017 at 09:00 on schedule and started the voyage in a SW direction towards our study area off Cape Blanc, Mauritania. Tuesday morning the 24th January we started our station work at the eutrophic site 'CBi' by recovering the 1500 m long mooring array CBi-14. The mooring consisted of two deep ocean sediment traps, one upper trap at 1356 m depth and one lower trap at 1913 m depth. Both traps had continuously collected sinking material in one 18.5 days interval and 14 intervals 21.5 days since the 25th February 2016. CBi-14 was further equipped with a newly developed BioOptical Platform (BOP) at 1251 m depth. BOP was equipped with 40 cups for time-series collection of intact marine snow particles (gel-filled cups), which had continuously sampled in the programmed intervals since the 25th February 2016. Above the gel-filled cups, BOP was equipped with a settling cylinder and a high resolution particle camera to detect particle sizes, abundance, and sinking rates. The camera had captured five minutes of image sequences once a day since the 25th February 2016. All in all, the CBi-14 mooring was successful. We redeployed the CBi mooring as CBi-15 on Wednesday 25th of February, this time without the BOP system since we planned to deploy this system on the CB

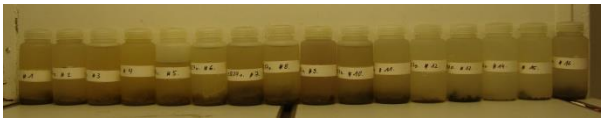
mooring 223 km further offshore. Between the recovery and deployment of the CBi mooring we investigated the relationship between falling particles and microbes and larger organisms through the water column. To do this we deployed one secchi disk, two CTD Rosettes with water sampling, one Marine Snow Catcher to catch sinking particles, two In Situ Camera profiles to quantify size-distribution and abundance of particles through the water column, two plankton net samples with a camera attached to image the vertical distribution of zooplankton at high resolution, one hand-net haul for zooplankton, and one overnight deployment of four In Situ Pumps. We also deployed a Multi Net two times, but unfortunately the closing mechanisms on the Multi Net was not functioning and we had to make do without those samples.

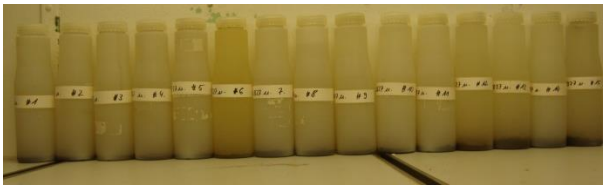
On Wednesday morning at 11:00, after recovery of In Situ Pumps and deployment of CBi-15, we steamed towards the CB site. We made four short stations during the transit, where we deployed of a Plankton net camera (LOKI) and the In Situ Camera at each station. On Thursday 26th January we recovered the CB-27 mooring at 08:30. The CB-27 mooring consisted of two deep ocean sediment traps, one at 1201 m depth and one at 3616 m depth. Both traps had sampled continuously in 21.5 days intervals since the 22nd of February 2016. While preparing for the re-deployment of the CB mooring, we investigated the particle dynamics through the water column at the CB site. This was done by deployments of one secchi disk, two In Situ Camera profiles, two camera net deployments (LOKI), one CTD-Rosette deployment, one Marine Snow Catcher, and deployment of four In Situ Pumps overnight. In addition, we deployed our first drifting array DF-15 at the CB site. The drifting array consisted of four cylindrical sediment traps at each of three depths; 100, 200 and 400 m. One of the four cylinders at each depth was filled with a viscous gel to preserve the shape and structure of the fragile settling particles.

On Thursday 27th January we deployed the CB-28 mooring, which consisted of two deep ocean sediment traps and the BioOptical Platform. After the deployment we steamed to the position of the drifting trap where we made one In Situ Camera profile and one camera net profile to determine the vertical distribution of zooplankton and particles near the trap position. Thereafter, we recovered the DF-15 drifting trap successfully. At 18:00 on Thursday we started our transect back in the direction of the more coastal CBi site. We made one station every 25 km and deployed the In Situ Camera and the camera net to 500 m at each station. In total we made nine stations before we arrived at our next drifting trap station (20°50.21'N, 18°29.50'W) at 14:00 on Sunday 29th January. After a Secchi disk deployment we deployed the second drifting trap, DF-16, and started our investigations of the particle dynamics at this more coastal influenced station. This was again done with deployments of In Situ Camera, Camera net, Marine Snow Catcher, CTD-Rosette, Hand-nets, and In Situ Pumps.









Left column: Images of the BioOptical Platform (BOP) to the left and a deep ocean sediment trap to the right. Right column: Collection bottles from the four traps recovered during POS508. The upper two rows are for the CBi-14 mooring with the upper trap on top and the lower trap in the second row from above. The lower two rows are for the CB-27 mooring with the upper trap in the third row from above and the lower trap in the bottom row.

Viele Grüße von der Crew und dem Forschungsteam.

Dr. Morten Iversen